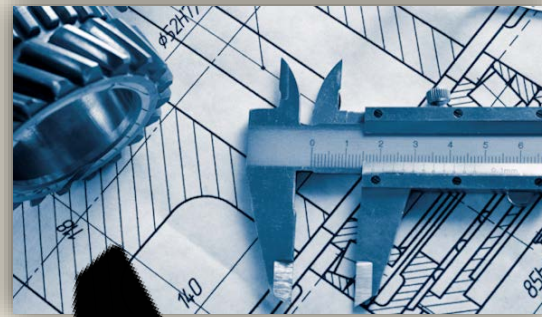


# IN THE END, I'M REALLY JUST STUDYING MYSELF

An introduction to engineering education, research design and research  
question development

Nathan Canney, PhD, PE



How did I become the engineer that I am today?

How does any engineer become who they are in their profession?



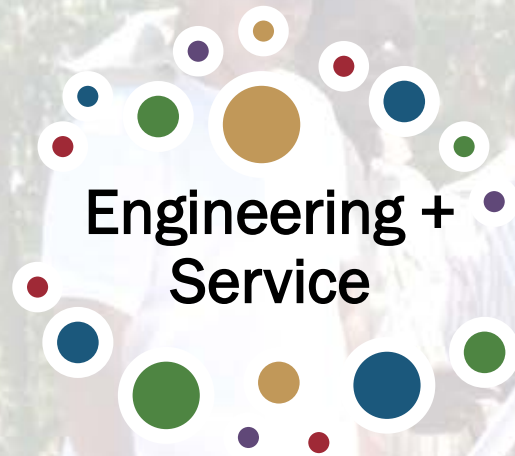
BRIEFLY SHARE ONE  
FORMATIVE EXPERIENCE  
THAT HAS IMPACTED  
YOUR JOURNEY

# Today's Goals

1. Exemplify how personal experiences can form the basis for scholarly engineering education research
2. Explore the relationship between personal experiences/observations, study topics, and root phenomenon
3. Develop research questions
4. Preview next steps to move from research questions to study design and execution



# From formative life experiences to scholarly engineering education research

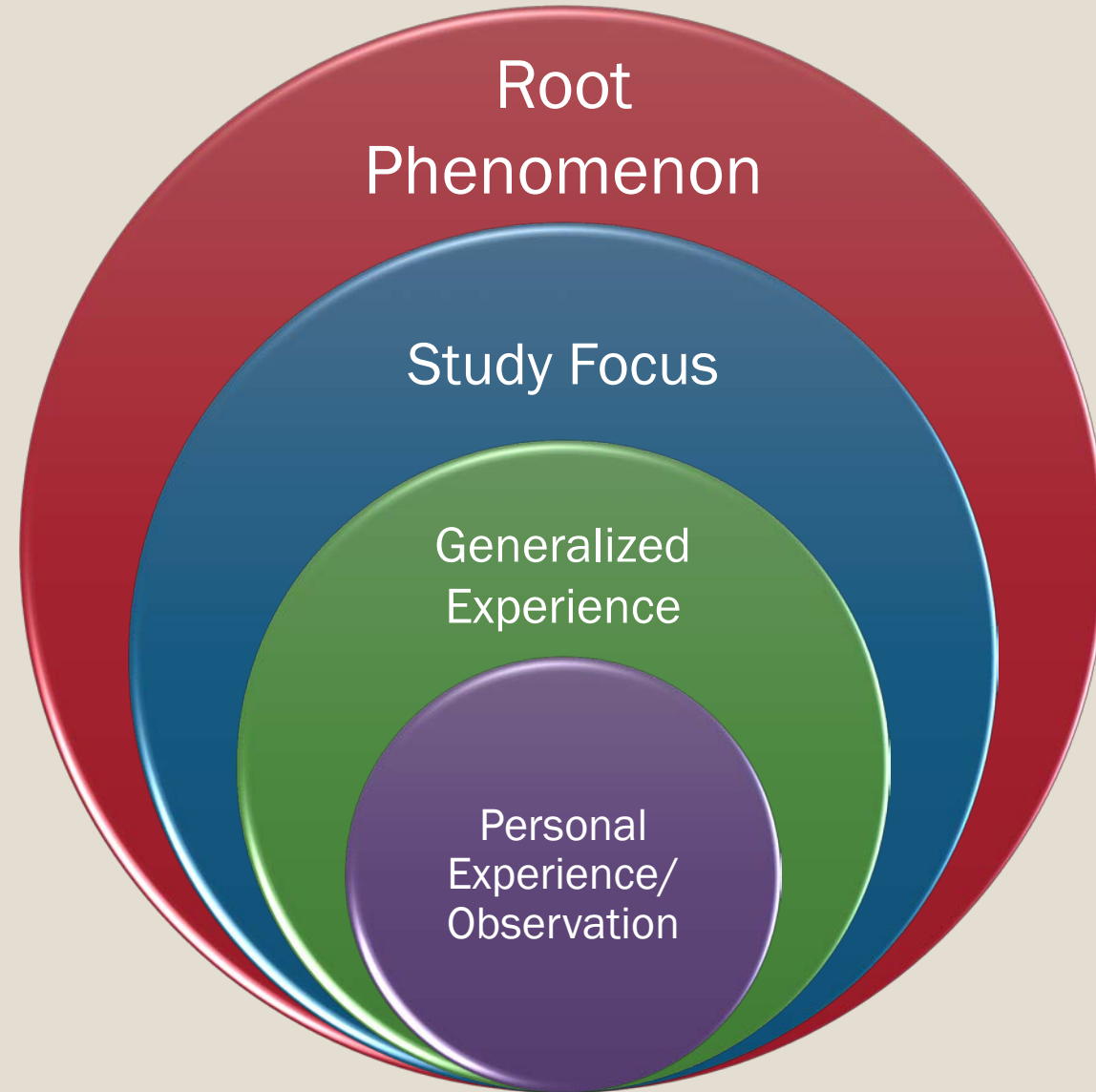


Social  
Responsibility

Service  
Learning

Engineering  
Identity  
Formation

Pedagogical  
Assessment



Engineering identity formation

Assessing engineers' understanding of social responsibility

How did engagement in service affect other students/engineers?

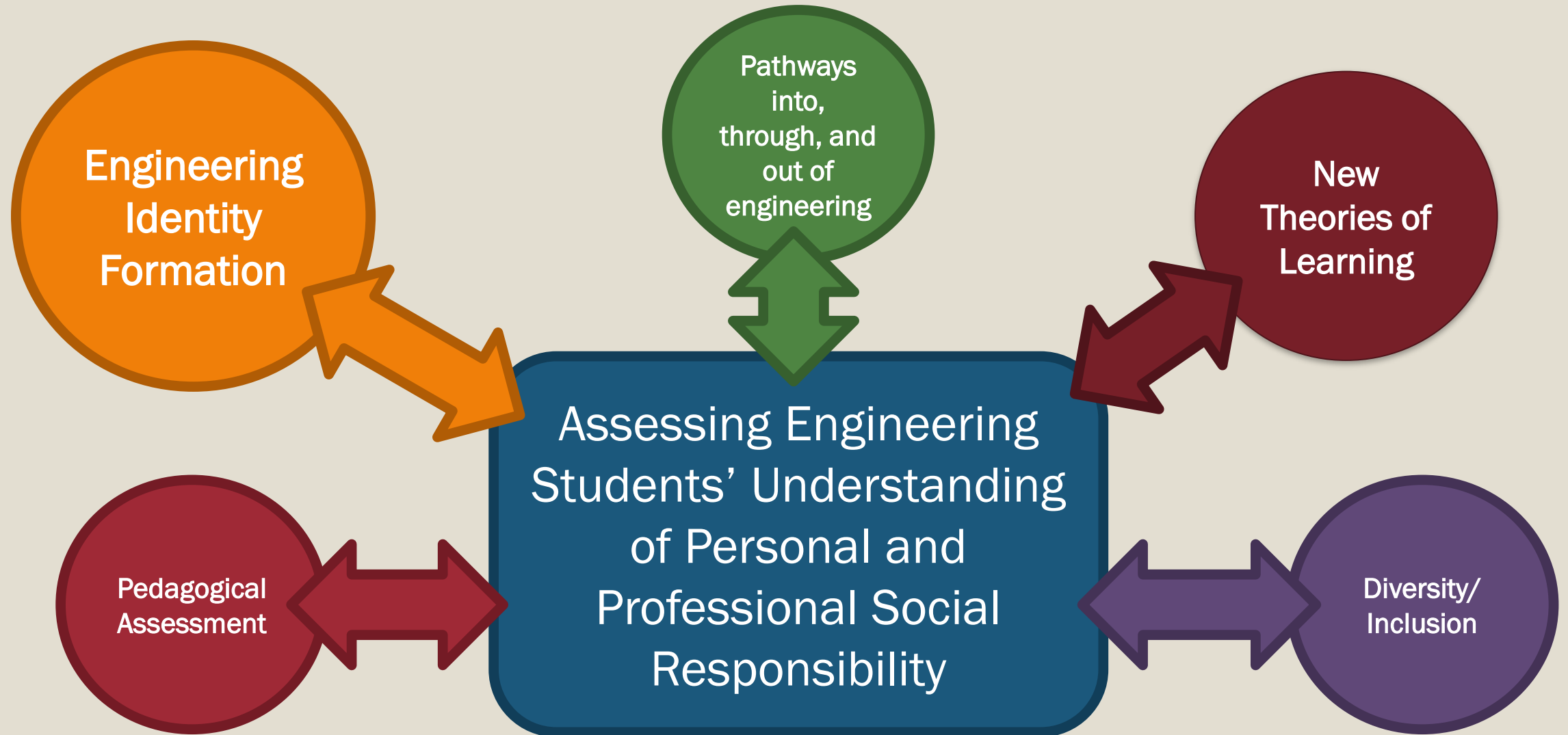
How engagement in service had shaped my pathway in engineering and how I saw myself as an engineer

# Classes of phenomena for engineering education studies





# Example: Classes of phenomena for engineering education studies



# What is your study focus?

## What phenomenon is central to this topic?

## What might be tangential phenomena?



# Research Question Development

## Example 1: Social Responsibility



### My Experience/Observation

Service experiences outside of engineering influenced my view of my role in society

I had to work internally to connect engineering to my views of service

My views of my role as an engineer in society influenced my career pathway

### Questions about Generalized Experience

What experiences shape how engineering students see their **role in society**?

What are students' beliefs and attitudes towards ideas of social responsibility?

How are personal and professional social responsibility connected?

How does engagement in engineering service affect the career pathways of alumni?

= Social Responsibility

**Study Design**  
(later)

A large, light blue arrow points from the 'Study Design (later)' text towards the right side of the slide.

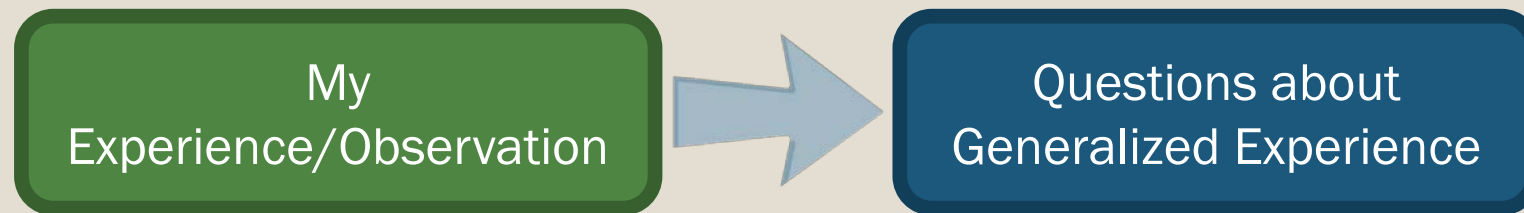
# Research Question Development

## Example 2: Engineers' Conceptions of "the Public"

|   | My Experience/Observation  | Questions about Generalized Experience  |
|---|--|---|
| I learned this through experience in ESW and graduate work  | In development projects, the community provides critical local knowledge and context, key to project success                             | How do engineers perceive the public today?   |
| From my own experience as a student and teacher   | Students rarely interact with members of the public – the public or a client is often imagined in engineering problems if present at all | What formal and informal processes in engineers' professional formation shape these perceptions?  |
| My colleague had experienced this as a non-engineer involved in the DC water contamination crisis | Tragedies like the water contamination in Flint, MI were first noticed by local residents, but did not stop right away                   | Do these perceptions present differently in engineers at different stages in their professional formation and, if so, what factors precipitate these differences? |
|   |  | How are these perceptions expressed <i>in practice</i> and what impact might they have on engineers' relationship with diverse publics?                           |

# Research question development

Chart your lived experience/observations and map them to research questions about a generalized experience



Share your research questions with a partner



# From Research Questions to Study Design

You must have a plan



# From Research Questions to Study Design

## “Show and Tell” Education Research

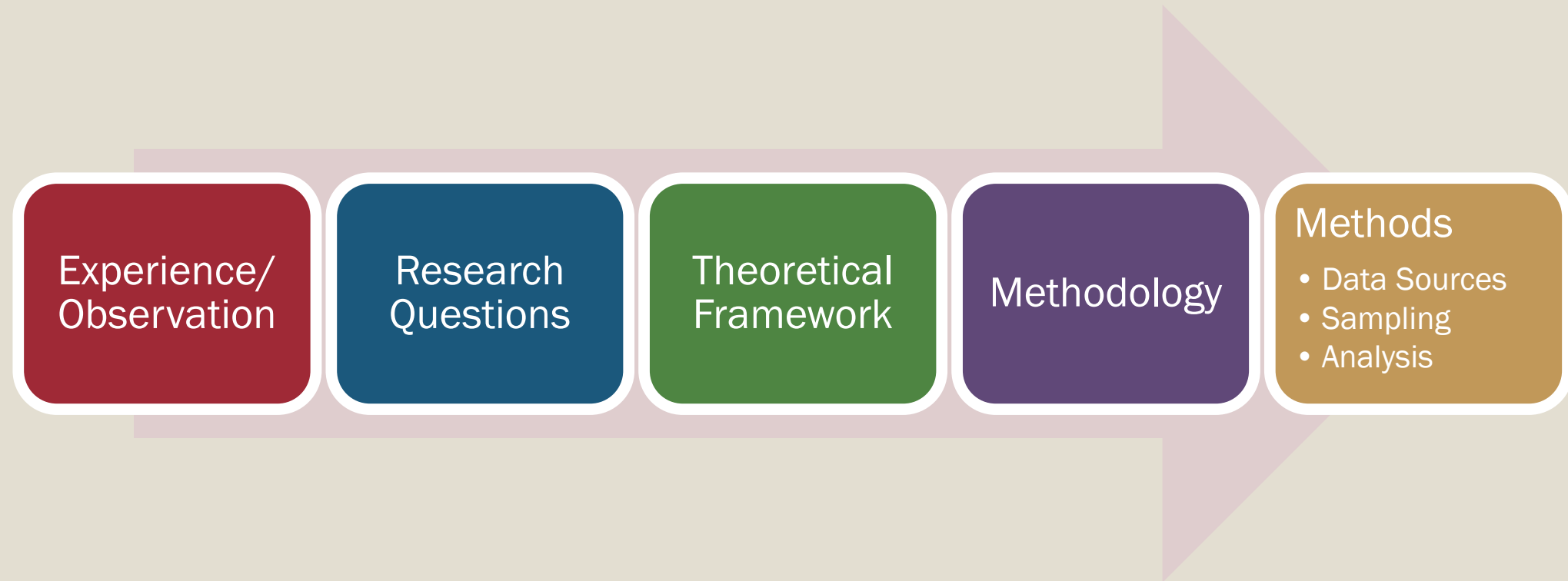
## Scholarly Engineering Education Research

Data  
Collection

- Tends to be convenience sampling, selected through easy access rather than as a larger strategy to “tell a story” – this is usually the start for the research

- Follows a plan, predetermined populations to capture representative or generalized groups or outliers, based on study design

# A Framework for Scholarly Study Design in Engineering Education



# A Framework for Scholarly Study Design

## Theoretical Perspective:

the philosophical stance informing the methodology and thus providing a context for the process and grounding its logic and criteria.

The big picture view of your research intention:

1. Increasing understanding of people's subjective experiences (interpretivism)
2. Critiques of social inequities and power relationships (critical theory)
3. Aims to deconstruct taken for granted 'truths' (poststructuralism & postmodernism)

# A Framework for Scholarly Study Design

## **Theoretical Perspective:**

the philosophical stance informing the methodology and thus providing a context for the process and grounding its logic and criteria.

## **Methodology:**

the strategy, plan of action, process, or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes.

This communicates intentionality in our study. Why we did what we did and what it can tell us.



# A Framework for Scholarly Study Design

## **Theoretical Perspective:**

the philosophical stance informing the methodology and thus providing a context for the process and grounding its logic and criteria.

## **Methodology:**

the strategy, plan of action, process, or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes.

**Example: Case Studies** – “an in-depth study or examination of a distinct, single instance of a class of phenomena...”

# A Framework for Scholarly Study Design

## **Theoretical Perspective:**

the philosophical stance informing the methodology and thus providing a context for the process and grounding its logic and criteria.

## **Methodology:**

the strategy, plan of action, process, or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes.

## **Methods:**

the techniques or procedures used to gather and analyze data related to some research question or hypothesis.

# Engineers' Conceptions of "the Public"

Experience/  
Observation

Research  
Questions

Theoretical  
Framework

Methodology

Methods

- Data Sources
- Sampling
- Analysis

How do engineers perceive the public today?

Do these perceptions present differently in engineers at different stages in their professional formation and, if so, what factors precipitate these differences?

What formal and informal processes in engineers' professional formation shape these perceptions?

How are these perceptions expressed *in practice* and what impact might they have on engineers' relationship with diverse publics?

# Engineers' Conceptions of "the Public"

Experience/  
Observation

Research  
Questions

Theoretical  
Framework

Methodology

Methods

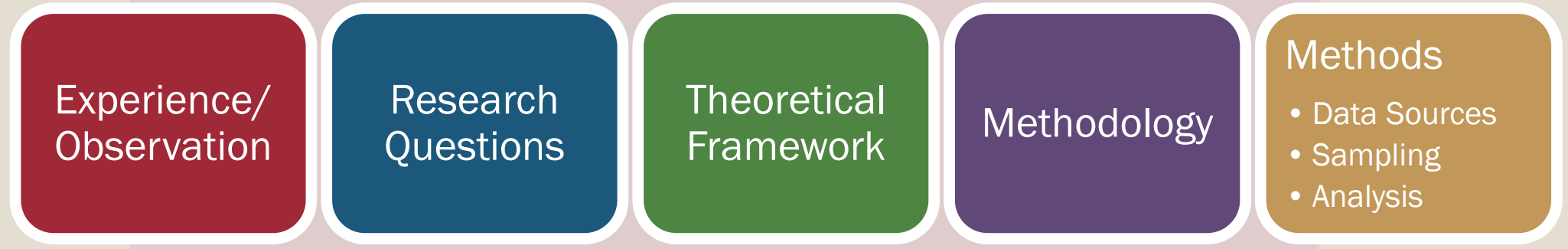
- Data Sources
- Sampling
- Analysis

## Social Imaginaries:

“The ways people imagine their social existence, how they fit together with others, how things go on between them and their fellows, the expectations that are normally met, and the deeper normative notions and images that underlie these expectations.”

- Charles Taylor

# Engineers' Conceptions of "the Public"



## Embedded Single Case Study:

A single case (or issue) is studied. In this instance, the single case is engineers' conceptions (or social imaginaries) of "the public", what they are, how they develop and how they are expressed.



# Engineers' Conceptions of "the Public"

Experience/  
Observation

Research  
Questions

Theoretical  
Framework

Methodology

Methods

- Data Sources
- Sampling
- Analysis

## Data Sources:

- Professional Documents
- Interviews with engineers
- Interviews with members of the public

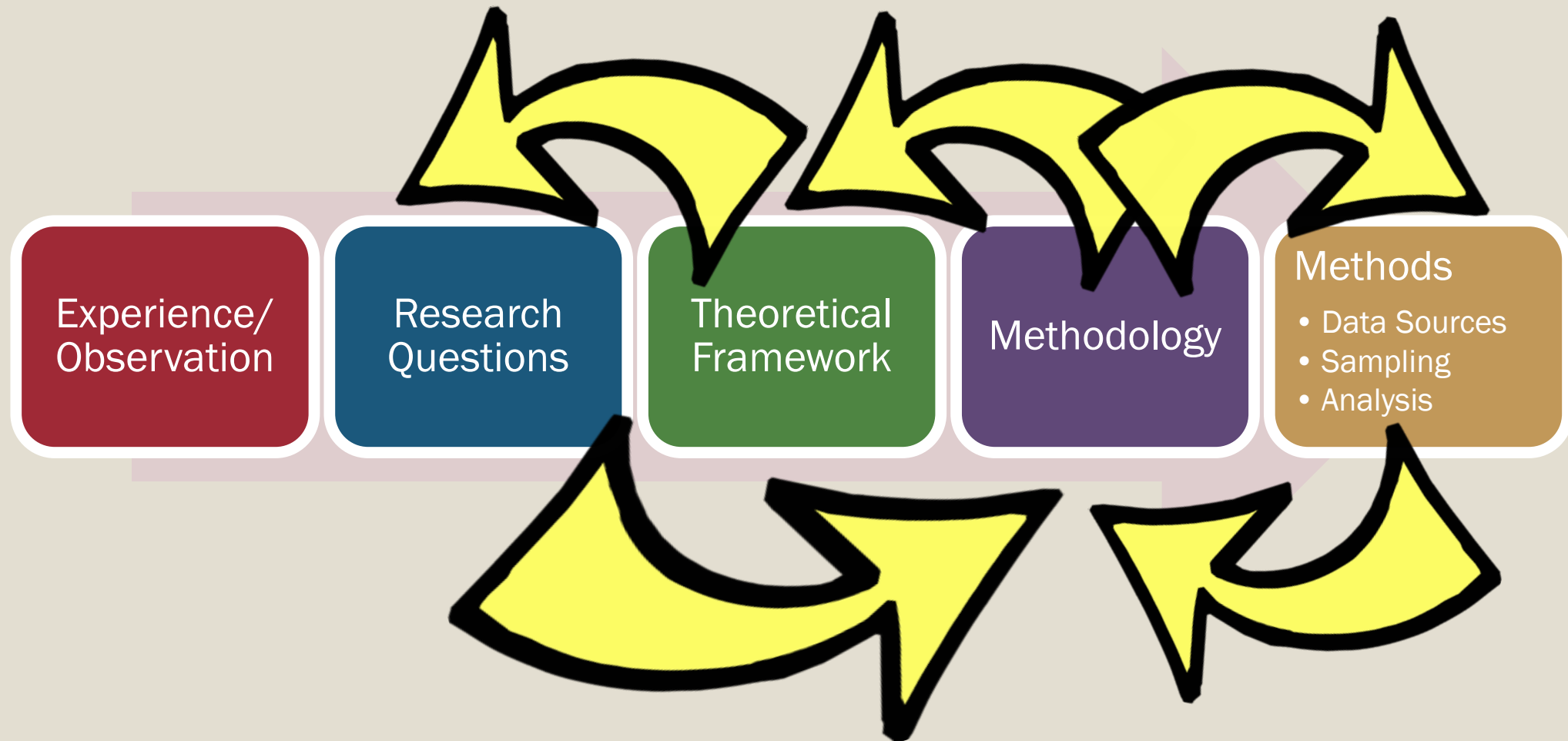
## Sampling:

- Purposeful sampling from home institutions
- Snowball sampling from recommendations from other participants

## Analysis:

- Emergent thematic coding

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THANK YOU

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